

# **Improving Stock Market Intraday Prediction by Generative Adversarial Neural Networks**

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## **Abstract**

In this study, we introduce a novel framework for enhancing intraday stock price forecasting by leveraging synthetic data to train a predictive model. Recognizing the inherent challenges of short-term stock market predictions due to their volatile and noisy nature, we propose a solution that employs a conditional Wasserstein Generative Adversarial Network with gradient penalty (WGAN-GP) and a mode-normalization procedure to generate highly realistic synthetic data.

The synthetic data, which closely mirrors real stock price data, is used to enrich the training dataset, providing the forecasting model with a broader range of examples to learn from. For the forecasting task, we utilize a Long Short-Term Memory (LSTM) network, a type of recurrent neural network renowned for its ability to model sequential data and learn long-term dependencies, making it particularly suited for intraday stock forecasting.

Our framework employs a WGAN-GP, a variant of the traditional GAN architecture, known for its stability and ease of training. The WGAN-GP uses a Wasserstein loss function, a robust measure of distance between two distributions, and a gradient penalty term to prevent overfitting of the discriminator to the training data.

To further enhance the stability of our GANs, we incorporate a technique known as mode normalization. This process normalizes the activations of the generator network to ensure a constant mean and variance, preventing the generation of unrealistic samples.

We evaluate our proposed framework using both quantitative and qualitative criteria. That includes : distributions similarity, distributional metric, ablation study, temporal autocorrelation and, predictive Score.

The experimental findings demonstrate a substantial boost in forecasting accuracy. These contributions have the potential to advance the development of more accurate forecasting tools and assist traders in simulating diverse market scenarios for improved financial risk management.

### **Keywords**

Stock Price Prediction; Conditional Generative Adversarial Net; Long Short-Term Memory (LSTM), Synthetic Examples.

### **Biographies**

**Badre LABIAD** is an engineer from the National Institute of Statistics and Applied Economy (INSEA, 2007), Rabat, Morocco. Currently, a PhD student since 2016 at AMIPS research team, Ecole Mohammadia d'Ingénieurs (EMI), University Mohammed V, Rabat, Morocco. He has 16 years of experience in capital market supervision and is holding the position of Head of the Surveillance and Investigations Department within the Moroccan Capital Market Authority.

**Dr. Loubna BENABBOU** is a Professor of Management Sciences at Université du Québec à Rimouski (UQAR) at Lévis campus. Her research work lies in the application of decision/ management sciences and machine learning techniques to transform data for making better decisions and improving operational processes. Dr. Benabbou has been supervising several undergraduate and graduate students in projects for different Industries related to the areas of Decision Sciences, Machine Learning and Operations Management. Her research related to these fields has been published in international scientific journals and conferences' proceedings. Dr. Benabbou was an associate professor of Industrial Engineering at EMI School of Engineering. She was also a trader at Casablanca stock exchange and financial analyst and risk manager at the Caisse Marocaine des retraites the Moroccan largest institutional fund manager. Dr. Benabbou is an industrial engineer from EMI School of Engineering; she earned an MBA and Ph.D. in Management and Decision Sciences from Laval University.

**Abdelaziz BERRADO, Ph.D.** is a Professor of Industrial Engineering in EMI School of Engineering at Mohammed V University in Rabat. He holds degrees in Decision Systems and Industrial Engineering. He is interested in the areas of Machine Learning, Industrial Statistics, Operations and Supply Chain Modelling, Planning and Control with applications in healthcare and other industries. He published several papers in research journals and conferences with local and international funding. He is a fellow of IEOM society and a member of INFORMS and IEEE. Previously, he was also a senior engineer at Intel.